

SECTION 2

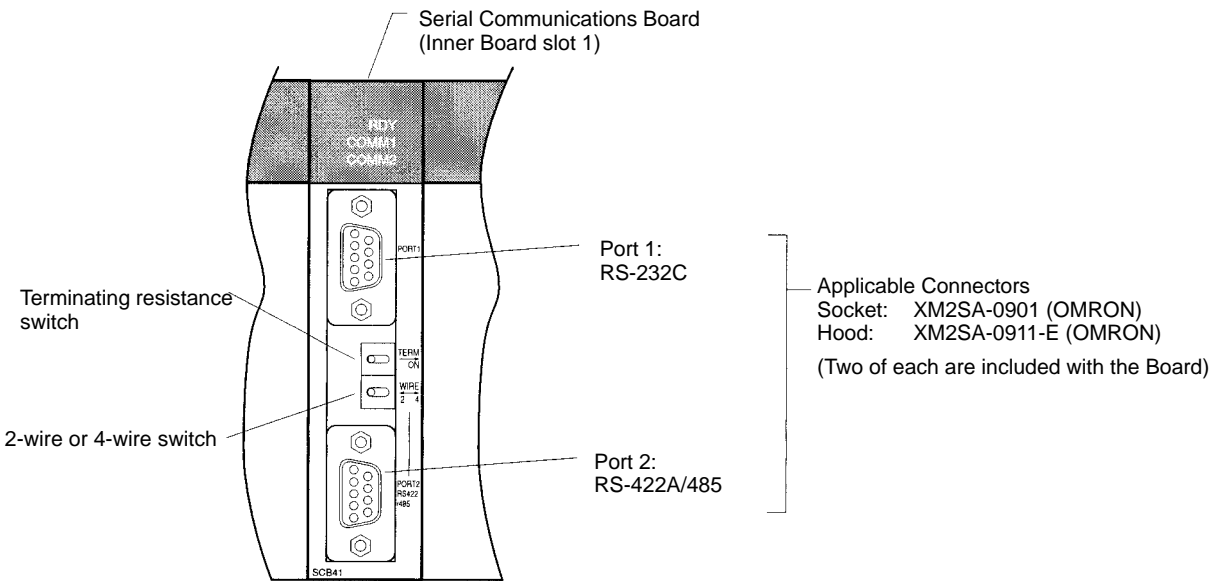
Board Components and Installation

This section describes the components of the Serial Communications Board, how to connect it in the CPU Unit, and how to connect it to external devices.

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2-1 Component Names and Functions

The components of the Serial Communications Board are described in this section.



2-1-1 Indicators

Board Indicators There are three LED indicators on the Board, as described below.

RDY

COMM1

COMM2

RDY: Lit when the Board is operational (green)

COMM1: Lit when data is being sent or received on the RS-232C port (Yellow)

COMM2: Lit when data is being sent or received on the RS-442A/485 port (Yellow)

Indicator	Color	Status	Meaning
RDY	Green	Lit	Operating normally, and protocol macro preparations have been completed.
		Flashing	There is an error in the PC Setup settings for the Board or in the protocol macros contained in the Board.
		Not lit	A hardware error has occurred in the Board.
COMM1	Yellow	Flashing	Port 1 is being used for sending or receiving.
		Not lit	Port 1 is not being used for sending or receiving.
COMM2	Yellow	Flashing	Port 2 is being used for sending or receiving.
		Not lit	Port 2 is not being used for sending or receiving.

CPU Unit Indicators

A Serial Communications Board is mounted as an Inner Board in the CPU Unit and thus affects the CPU Unit ERR/ALM indicator.

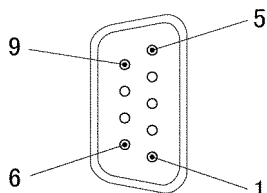
Indicator	Color	Status	Meaning	
ERR/ALM	Red	Lit	Fatal error	If a fatal error occurs, the CPU Unit will stop operation in either RUN or MONITOR mode.
		Flashing	Non-fatal error	If a non-fatal error occurs, the CPU Unit will continue operation in either RUN or MONITOR mode.
		Not lit	Normal operation	The CPU Unit is operating normally. This indicator will also not be lit when a watchdog timer error occurs.

If an error in the Inner Board is the cause of the error indicated on the ERR/ALM indicator, the Inner Board Error Flag (SR 25415) will turn ON and information on the error will be stored in AR 0400 to AR 0407. Refer to *Section 9 Troubleshooting and Maintenance* for details.

2-1-2 RS-232C Port

Protocol	Host Link	No-protocol	Protocol macros	1:1 Data Links	1:N NT Links	1:1 NT Links
Communications method	Half-duplex					
Synchronization	Start-stop synchronization (asynchronous)					
Baud rate	1,200/2,400/4,800/9,600/ 19,200 bps			19,200 bps	38,400 bps	19,200 bps
Connections	1:1 (1:N possible using Converting Link Adapters)			1:1	1:1 (1:N possible using Link Adapters)	1:1
Transmission distance	15 m max. (See note)					
Interface	Complies with EIA RS-232C					

Note The maximum cable length for RS-232C is 15 m. The RS-232C standard, however, does not cover baud rates above 19.2 Kbps. Refer to the manual for the device being connected to confirm support.

Connector Pin Layout

Pin No.	Abbreviation	Signal name	I/O
1 (See note 1)	FG	Shield	---
2	SD	Send data	Output
3	RD	Receive data	Input
4	RTS (RS)	Request to send	Output
5	CTS (CS)	Clear to send	Input
6 (See note 2)	5V	Power supply	---
7	DSR (DR)	Data set ready	Input
8	DTR (ER)	Data terminal ready (See note 4)	Output
9	SG	Signal ground	---
Shell (See note 1)	FG	Shield	---

Note

- Pin No. 1 and the shell are connected to the ground terminal (GR) of the Power Supply Unit inside the Serial Communications Board. Therefore, the cable shield can be grounded by grounding GR of the Power Supply Unit.
- Pin 6 (5 V) is required when the NT-AL001-E Link Adapter is connected. For details on connection methods, refer to *2-3 Wiring*.

Caution Do not connect the 5-V power supply of pin 6 to any external device other than an NT-AL001-E Link Adapter. Otherwise, the external device and the Serial Communications Board may be damaged.

The following cables are provided for connection to NT-AL001-E Link Adapters. We recommend that these cables be used.

NT-AL001-E connecting cables: XW2Z-070T-1 (0.7 m)
XW2Z-200T-1 (2 m)

Applicable Connectors

Socket: XM2A-0901 (OMRON) or equivalent
Hood: XM2S-0911-E (OMRON, conforms to ESD) or equivalent
One Socket and one Hood are provided for each port.

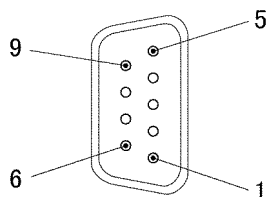
Recommended Cables

UL2464 AWG28 × 5P IFS-RVV-SB (UL-approved, Fujikura Ltd.)
AWG28 × 5P IFVV-SB (not UL-approved, Fujikura Ltd.)
UL2464-SB (MA) 5P × 28AWG (7/0.127) (UL-approved, Hitachi Cable, Ltd.)
CO-MA-VV-SB 5P × 28AWG (7/0.127) (not UL-approved, Hitachi Cable, Ltd.)
Cable length: 15 m max.

2-1-3 RS-422A/485 Port

Protocol	Host Link	No-protocol	Protocol macros	1:1 Data Links	1:N NT Links	1:1 NT Links
Communications method	Half-duplex					
4-wire, 1:1	OK	OK	OK	OK	OK	OK
4-wire, 1:N	OK	OK	OK	No	OK	No
2-wire, 1:1	No	No	OK	No	OK	No
2-wire, 1:N	No	No	OK	No	OK	No
Synchronization	Start-stop synchronous (asynchronous)					
Baud rate	1,200/2,400/4,800/9,600/ 19,200 bps			19,200 bps	38,400 bps	19,200 bps
Connections	1:N (N: 32 Units max.)			1:1	1:N (N: 8 Units max.)	1:1
Transmission distance	500 m max. (The total combined cable length is 500 m max. T-branch lines must be a maximum of 10 m long.)					
Interface	Complies with EIA RS-485					

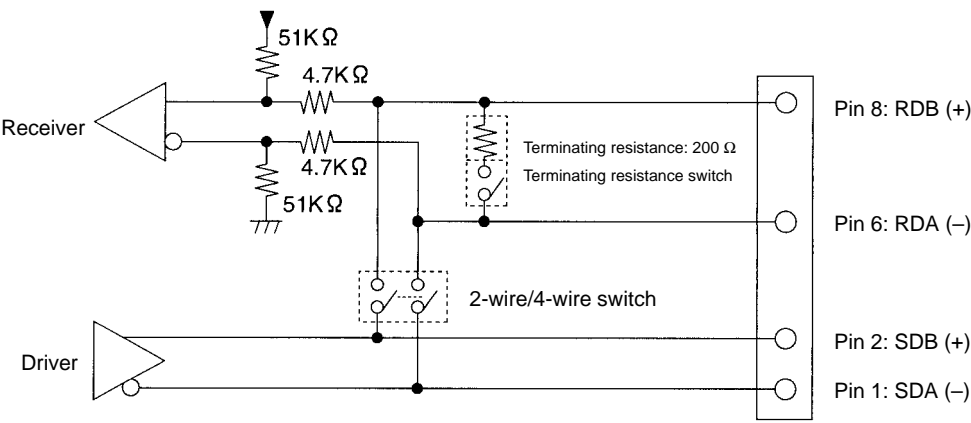
Connector Pin Layout



Pin No.	Abbreviation	Signal name	I/O
1 (See note 1)	SDA	Send data –	Output
2 (See note 1)	SDB	Send data +	Output
3	NC	Not used	---
4	NC	Not used	---
5	NC	Not used	---
6 (See note 1)	RDA	Receive data –	Input
7	NC	Not used	---
8 (See note 1)	RDB	Receive data +	Input
9	NC	Not used	---
Shell (See note 2)	FG	Shield	---

- Note**
- When 2-wire connections are used, use pins 1 and 2, or pins 6 and 8.
 - The shell is connected to the ground terminal (GR) of the Power Supply Unit inside of the Serial Communications Board. Therefore, the cable shield can be grounded by grounding the GR of the Power Supply Unit.

Internal Circuits The internal circuits for port 2 are shown below.



Caution Confirm polarities before connecting RS-422A/485 cables. Some devices require that SDA/B and RDA/B or signal polarities be reversed.

Applicable Connectors Socket: XM2A-0901 (OMRON) or equivalent
Hood: XM2S-0911-E (OMRON, conforms to ESD) or equivalent
One Socket and one Hood are provided for each port.

Recommended Cables CO-HC-ESV-3P × 7/0.2 (Hirakawa Hewtech Corp.)
Cable length: 500 m max.
(The total combined cable length is 500 m max. T-branch lines must be a maximum of 10 m long.)

2-1-4 Switches

The TERM and WIRE switches are on the front panel of the Serial Communications Board. Refer to page 10 for a diagram of the Board.

Terminating Resistance Switch When an RS-422/485 port is used, turn ON the switch if the Serial Communications Board is on the end of the transmission line. Refer to information on specific serial communications modes for the ON/OFF settings.

Label	Name	Settings	Factory setting
TERM	Terminating resistance switch	OFF: Terminating resistance OFF ON: Terminating resistance ON	OFF: Terminating resistance OFF

2-Wire or 4-Wire Switch When an RS-422/485 port is used, set the switch to 2 when 2-wire connections are used, and set the switch to 4 when 4-wire connections are used.

Label	Name	Settings	Factory setting
WIRE	2-wire or 4-wire switch	2: 2-wire 4: 4-wire	2: 2-wire

Note Host Link, no-protocol, and 1:1 Data Link modes cannot use 2-wire RS-422A/485 communications. Always use 4-wire connections when using RS-422A/485 communications for these serial communications modes. Refer to 2-3 *Wiring* for connections.

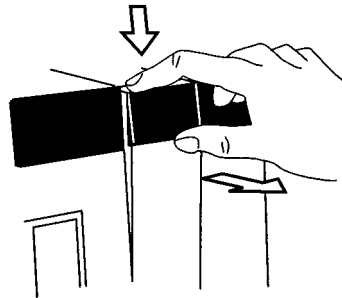
2-2 Installation

2-2-1 Mounting the Board

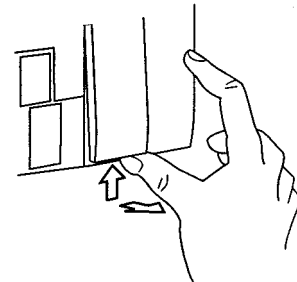
This section describes how to mount a Serial Communications Board in Inner Board slot 1 of a CPU Unit. Slot 1 is the slot on the left. Only one Serial Communications Board can be installed in each CPU Unit.

- Note**
1. The Serial Communications Board cannot be mounted in Inner Board slot 2.
 2. Always turn OFF the power before installing or removing the Serial Communications Board. Installing or removing the Serial Communications Board with the power ON can cause the CPU Unit to malfunction, damage internal components, or cause communications errors.
 3. Before handling the Serial Communications Board, touch a grounded metallic object in order to discharge any static build-up from your body.

- 1, 2, 3...**
1. Press the catches at the top and bottom of the Inner Board slot 1 compartment cover.

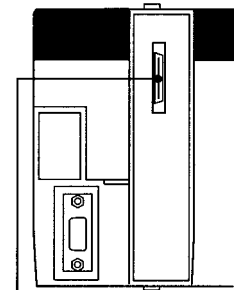
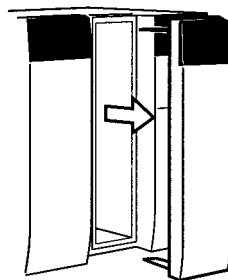


Press the top catch.



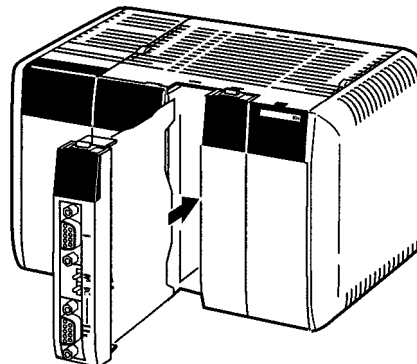
Press the bottom catch.

2. Remove the compartment cover.

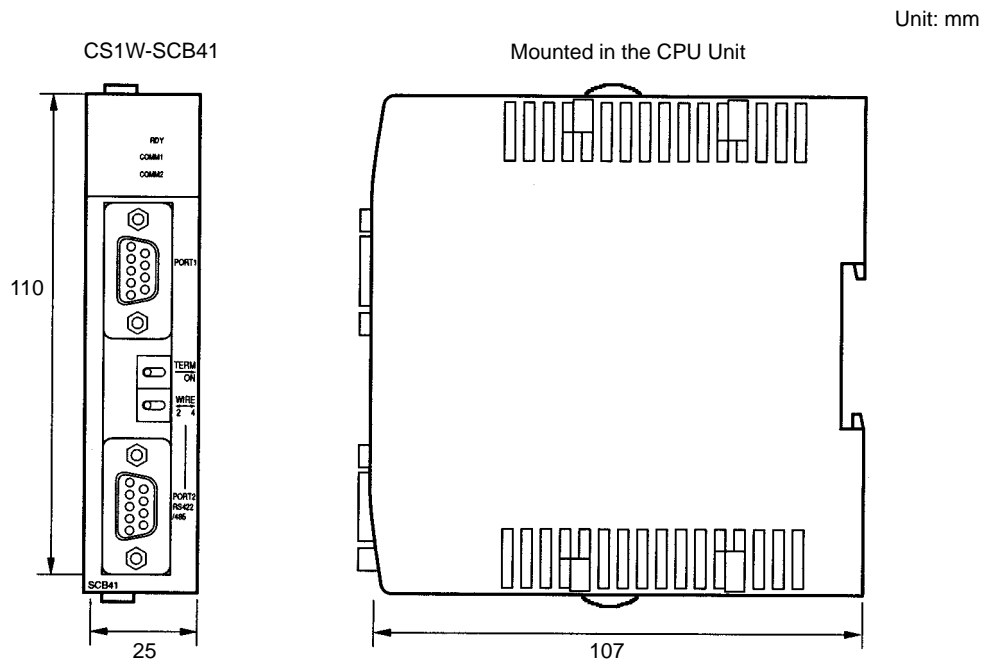


Inner Board Connector

3. Insert the Serial Communications Board.

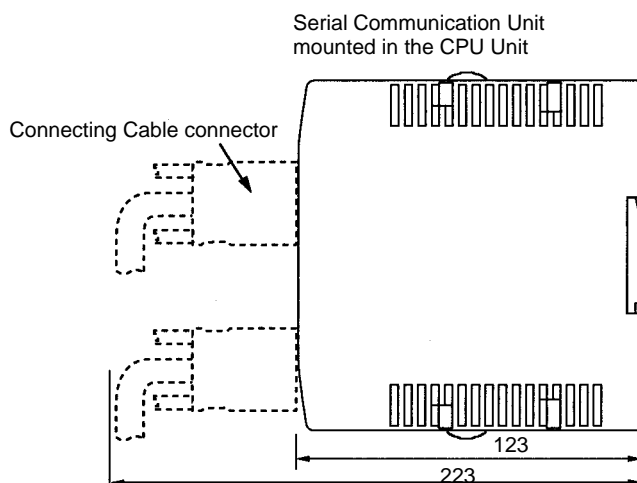


2-2-2 External Dimensions



2-2-3 Mounting Height and Connector Cover Dimensions

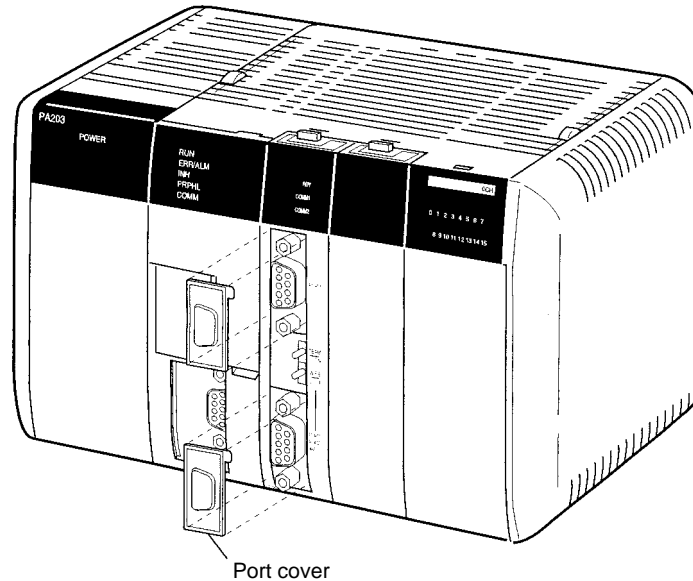
When mounting the Serial Communications Board, make sure to provide space for the mounting height and connector cover dimensions shown below.



Note The mounting heights shown above are applicable when the attached connectors, connector covers, and recommended cables are used. The mounting height may differ when other connectors, connector covers, and cables are used. Determine the mounting height, taking into account the connectors, connector covers, and the minimum bending radius of the cables.

2-2-4 Precautions in Handling the Board

- Turn OFF the power supply to the CPU Unit before mounting or removing the Board.
- Turn OFF the power supply to the CPU Unit before before connecting or disconnecting Board connectors or wiring.
- Separate the port connector lines from the high-tension or power lines to reduce external noise.
- Leave the port cover attached when not using a communications port.

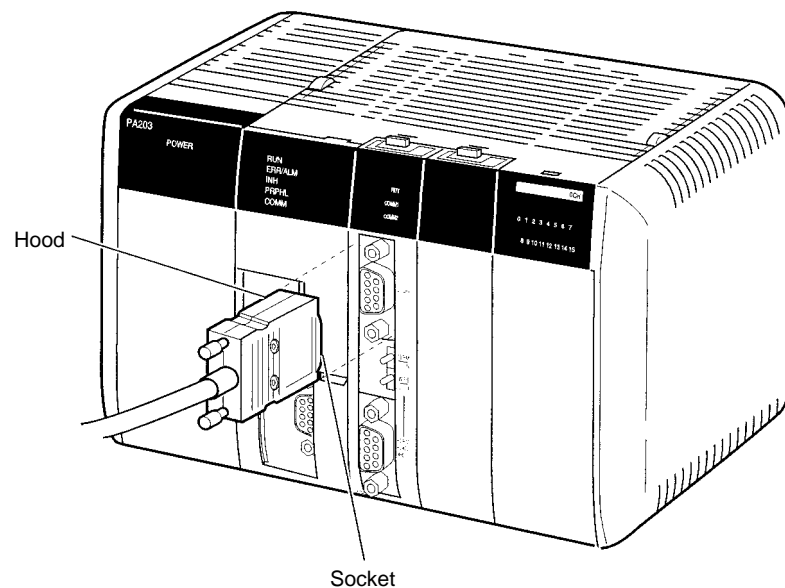


2-3 Wiring

2-3-1 Connectors

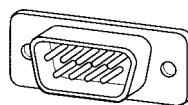
Prepare connecting cables for port 1 (RS-232C) and port 2 (RS422A/485) using the Sockets and Hoods provided with the Board and the recommended cables. Connection methods vary with the serial communications mode that is being used. Refer to the following sections for connection examples.

Host Link: *Section 4 Host Link Communications*
 Protocol macros: *Section 5 Protocol Macros*
 No-protocol: *Section 6 Non-protocol Communications*
 1:1 Data Links: *Section 7 Communications for 1:1 Data Links*
 NT Links: *Section 8 NT Link Communications*

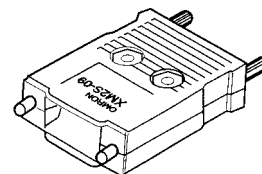


Standard Connectors (for Both RS-232C and RS-422A/485)

Name	Model	Specifications	
Socket	XM2A-0901	9-pin male	Used together (provided with Serial Communications Board).
Hood	XM2S-0911-E	For 9-pin, metric screws, conforms to ESD	



Socket:
XM2A-0901



Hood:
XM2S-0911-E

Recommended Cables

RS-232C Cables

Model	Manufacturer
UL2464 AWG28×5P IFS-RVV-SB (UL-approved) AWG28×5P IFVV-SB (not UL-approved)	Fujikura Ltd.
UL2464-SB (MA) 5P×AWG28 (7/0.127) (UL-approved) CO-MA-VV-SB 5P×AWG28 (7/0.127) (not UL-approved)	Hitachi Cable, Ltd.

RS-422A/485 Cable

Model	Manufacturer
CO-HC-ESV-3P×7/0.2	Hirakawa Hewtech Corp.

Refer to pages 11 and 12 for the connector pin layouts. Refer to *2-3-5 Recommended RS-232C Wiring Examples* and *2-3-6 Recommended RS-422A/485 Wiring Examples* for wiring examples, and to *2-3-7 Wiring Connectors* for wiring methods.

Standard cables are available for connection to personal computers and PTs. Refer to *Section 4 Host Link Communications* for personal computer cables and to your PT user's manual for PT cables.

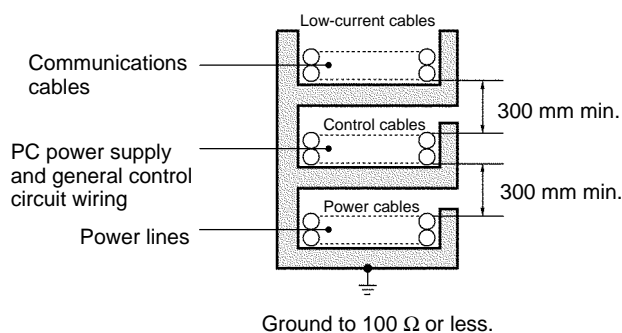
2-3-2 Wiring Precautions

- Before connecting or disconnecting the communications cables, always make sure that the PC is turned OFF.
- Tighten the communications connector screws firmly with your fingers.
- Serial Communications Boards can be connected to various devices. For compatibility, refer to the operation manuals for the devices to which they are to be connected.

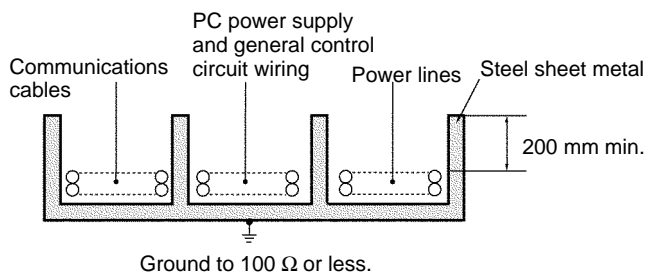
2-3-3 Reducing Electrical Noise for External Wiring

Observe the following precautions for external wiring.

- When multi-conductor signal cable is being used, avoid using I/O wires and other control wires in the same cable.
- If wiring racks are running in parallel, allow at least 300 mm between the racks.



- If the I/O wiring and power cables must be placed in the same duct, they must be shielded from each other using grounded steel sheet metal.



2-3-4 Port Applicability and Restrictions for 2-Wire/4-Wire Connections

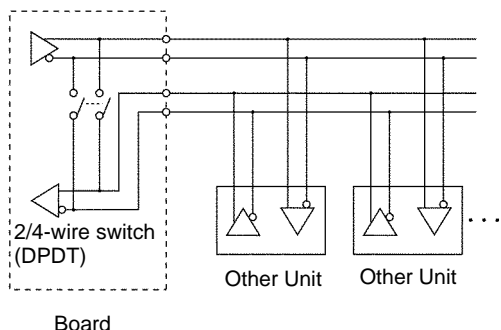
The following table shows the port connections that can be used for each serial communications mode.

Serial communications mode	RS-232C port		RS-422A/485 port			
	1:1	1:N	4-wire		2-wire	
			1:1	1:N	1:1	1:N
Host Link	OK	OK (See note 2)	OK	OK	No	No
Protocol macros	OK		OK	OK	OK	OK
No-protocol	OK		OK	OK	No	No
1:1 Data Links	OK	No	OK	No	No	No
1:N-mode NT Links	OK		OK	OK	OK	OK
1:1-mode NT Links	OK	No	OK	No	No	No

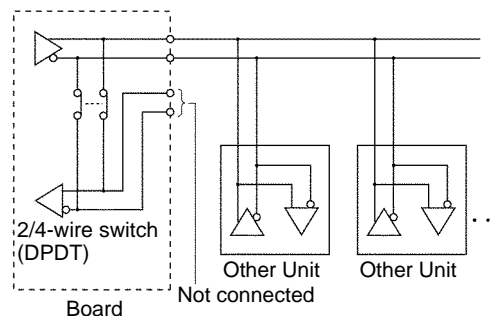
- Note**
1. The 1:N connection method can be used by converting between RS-232C and RS-422A/485 through NT-AL001-E Converting Link Adapters.
 2. Use 4-wire connections between the Converting Link Adapters.
 3. The 2-wire RS-422A/485 connections cannot be used for Host Link communications. Use 4-wire connections.

The transmission circuits for 2-wire and 4-wire connections are different, as shown in the following diagram.

Example of 4-Wire Connections



Example of 2-Wire Connections



- Note**
1. Use the same transmission circuit (2-wire or 4-wire) for all nodes.
 2. Do not use 4-wire connections when the 2/4-wire switch on the Board is set to 2-wire.

NT-AL001-E Link Adapter Settings

The NT-AL001-E Link Adapter has a DIP switch for setting RS-422A/485 communications conditions. When connecting the Board, refer to the DIP switch settings shown in the following table.

Pin	Function	Factory setting
1	Not used. Always set this pin to ON.	ON
2	Built-in terminating resistance setting ON: Connects terminating resistance. OFF: Disconnects terminating resistance.	ON
3	2/4-wire setting	OFF
4	2-wire: Set both pins to ON. 4-wire: Set both pins to OFF.	OFF
5	Transmission mode (See note) Constant transmission: Set both pins to OFF.	ON
6	Transmission performed when CTS signal in RS-232C interface is at high level: Set pin 5 to OFF and pin 6 to ON. Transmission performed when CTS signal in RS-232C interface is at low level: Set pin 5 to ON and pin 6 to OFF.	OFF

Note When connecting to a CQM1H-series CPU Unit, turn OFF pin 5 and turn ON pin 6.

2-3-5 Recommended RS-232C Wiring Examples

It is recommended that RS-232C cables be connected as described below, especially when the Serial Communications Board is used in an environment where it is likely to be subject to electrical noise.

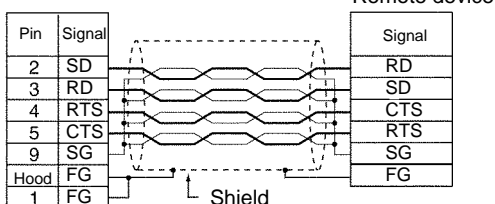
- 1, 2, 3...** 1. Always use shielded twisted-pair cables as communications cables.

Model	Manufacturer
UL2464 AWG28x5P IFS-RVV-SB (UL-approved) AWG28x5P IFVV-SB (not UL-approved)	Fujikura Ltd.
UL2464-SB (MA) 5Px28AWG (7/0.127) (UL-approved) CO-MA-VV-SB 5Px28AWG (7/0.127) (not UL-approved)	Hitachi Cable, Ltd.

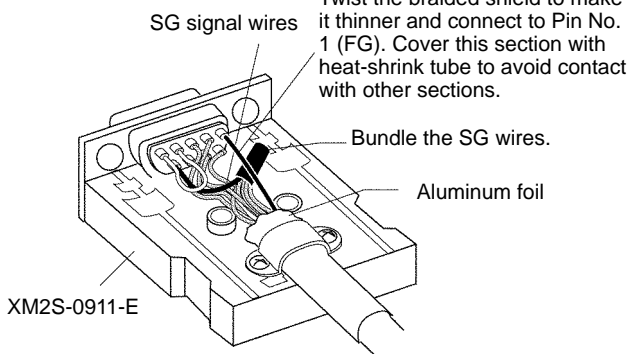
- Combine signal wires and SG (signal ground) wires in a twisted-pair cable. At the same time, bundle the SG wires to the connectors on the Serial Communications Board and the remote device.
- Connect the shield of the communications cable to the Hood (FG) terminal of the RS-232C connector on the Serial Communications Board. At the same time, ground the ground (GR) terminal of the Power Supply Unit to 100 Ω or less.
- A connection example is shown below.

Example: Twisted-pair Cable Connecting SD-SG, RD-SG, RTS-SG, and CTS-SG Terminals

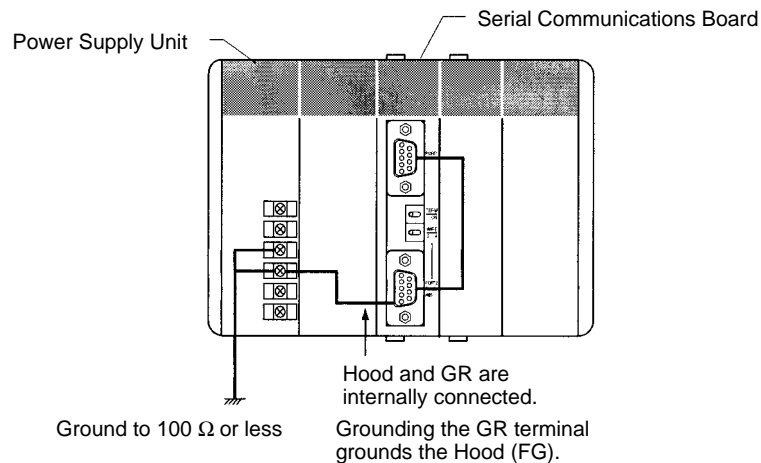
Serial Communications Board



Actual Wiring Example



Note The Hood (FG) is internally connected to the ground terminal (GR) on the Power Supply Unit. Therefore, FG is grounded by grounding the ground terminal (GR) on the Power Supply Unit. Although there is conductivity between the Hood (FG) and pin 1 (FG), connect the Hood (FG) to the shield because the Hood (FG) has smaller contact resistance with the shield than pin 1 (FG), and thus provides better noise resistance.



2-3-6 Recommended RS-422A/485 Wiring Examples

Recommended RS-422A/485 Cable

We recommend the following wiring methods to ensure quality transmissions for RS-422A/485 communications.

- 1, 2, 3... 1. Always use shielded twisted-pair cables for the communications cables.

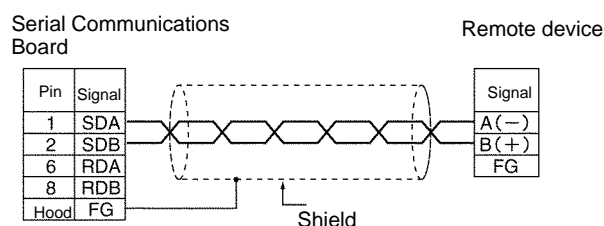
Model	Manufacturer
CO-HC-ESV-3Px7/0.2	Hirakawa Hewtech Corp.

2. Connect the shield of the communications cable to the Hood (FG) of the RS-422A/485 connector on the Serial Communications Board. At the same time, ground the ground (GR) terminal of the Power Supply Unit to 100 Ω or less.

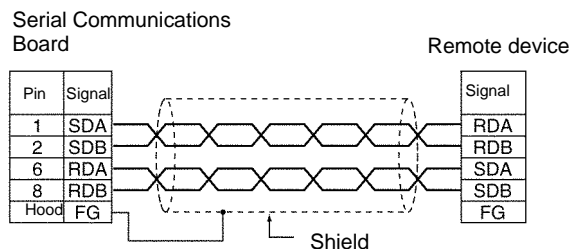
Note Always ground the shield only at the Board end. Grounding both ends of the shield may damage the device due to the potential difference between the ground terminals.

Connection examples are shown below.

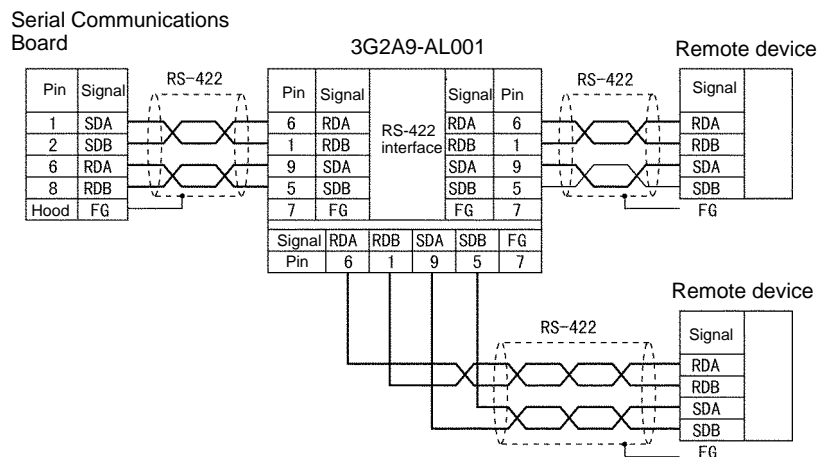
2-Wire Connections



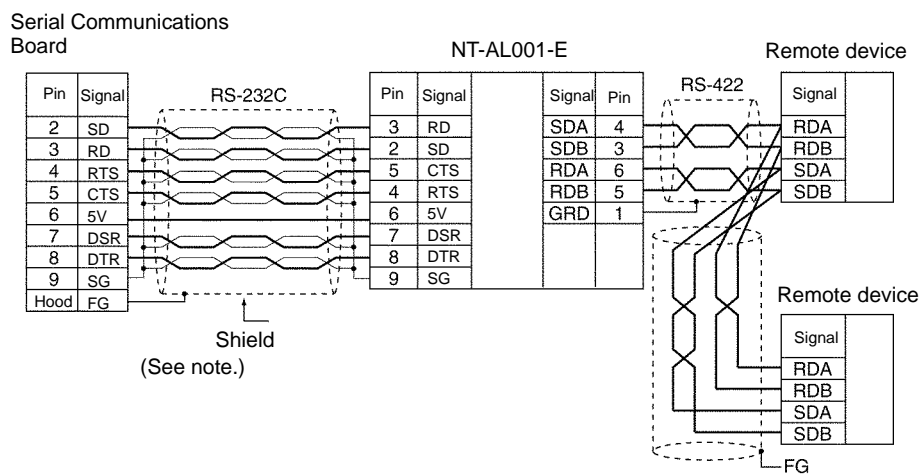
4-Wire Connections



Using a 3G2A9-AL001 Link Adapter



Using an NT-AL001-E RS-232C/RS-422 Link Adapter

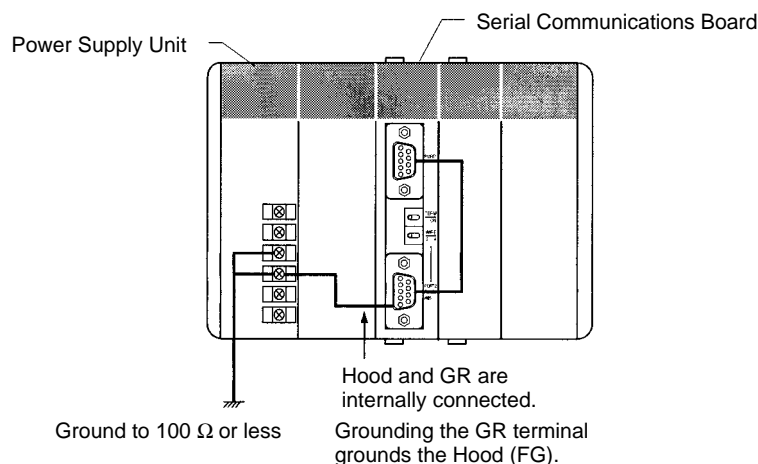


Note The following cables are available for this connection.

Length	Model
70 cm	XW2Z-070T-1
2 m	XW2Z-200T-1

It is recommended that one of these cables be used to connect the RS-232C port on the Serial Communications Board to the NT-AL001-E Converting Link Adapter.

Note The Hood (FG) is internally connected to the ground terminal (GR) on the Power Supply Unit. Therefore, FG is grounded by grounding the ground terminal (GR) on the Power Supply Unit.



3. Be sure to turn ON the terminating resistance at the last Unit at the end of the RS-422A/485 cable.

2-3-7 Wiring Connectors

Use the following steps to wire connectors.

Cable Preparation

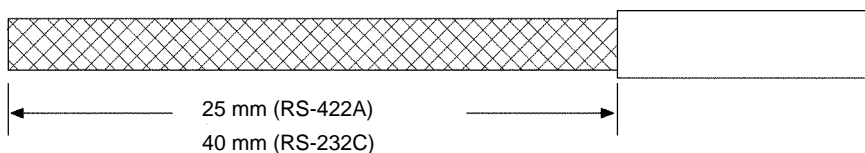
See the following diagrams for the length of the cable portion to be cut in each step.

Shield Connected to Hood (FG)

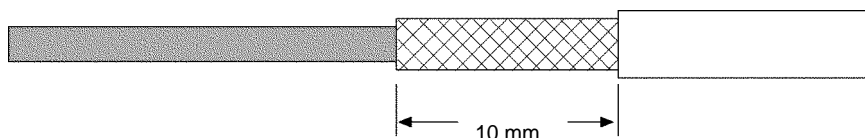
- 1, 2, 3... 1. Cut the cable to the required length.



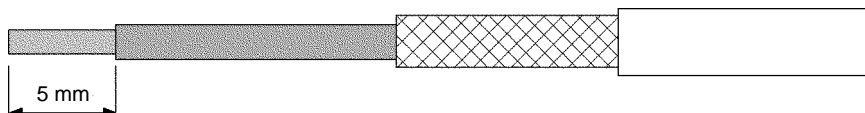
2. Remove the specified length of the sheath from the cable using a knife. Be careful not to scratch the braided shield.



3. Trim off the braided shield using scissors so that the remaining shield length is 10 mm.



4. Remove the insulation from each conductor using a stripper so that the exposed conductor length is 5 mm.



5. Fold back the braided shield.



6. Wrap aluminum foil tape around the folded shield.

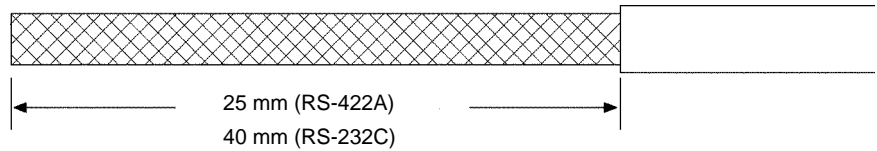


Shield Not Connected to Hood (FG)

- 1, 2, 3... 1. Cut the cable to the required length.



2. Remove the specified length of the sheath from the cable using a knife. Be careful not to scratch the braided shield.



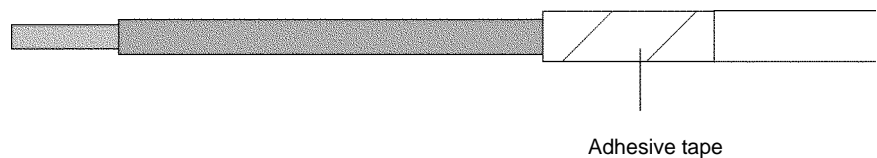
3. Trim off all the braided shield using scissors.



4. Remove the insulation from each conductor using a stripper so that the exposed conductor length is 5 mm.

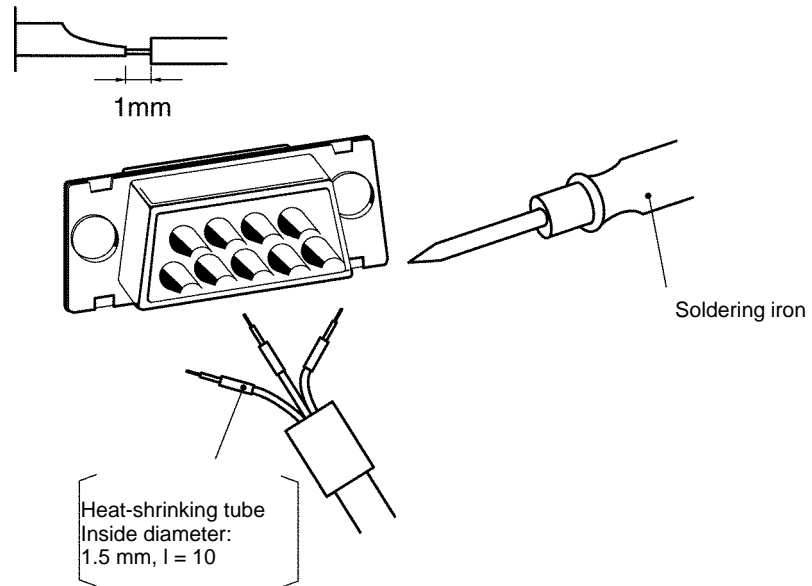


5. Wrap adhesive tape around the conductor from which the braided shield was removed.

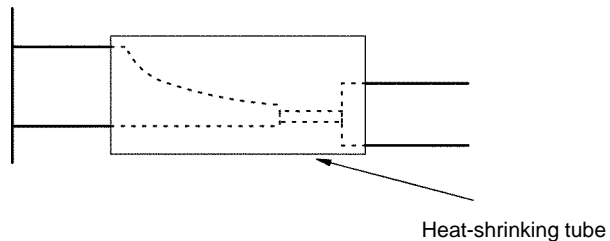


2-3-8 Soldering

- 1, 2, 3...
1. Thread a heat-shrinking tube through each conductor.
 2. Temporarily solder each conductor to the corresponding connector terminals.
 3. Completely solder each conductor.

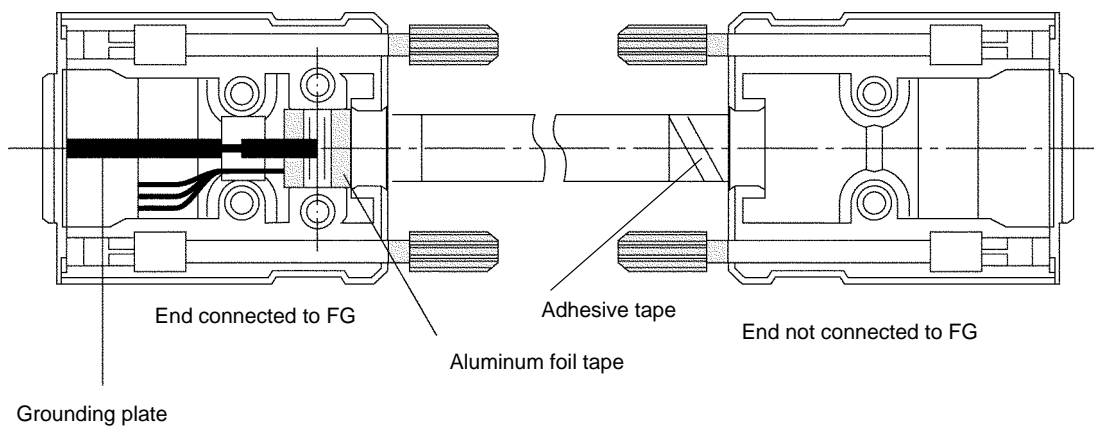


4. Return the heat-shrinking tube to the soldered portion, then heat the tube to shrink it in place.



2-3-9 Assembling Connector Hood

Assemble the connector Hood as shown below.



2-3-10 Connecting to the Board

Tighten the screws firmly
with your fingers.

